THE SUBMERGED PLATEAU SURROUNDING CEYLON: SOME CONSIDERATIONS REGARDING THE FORMATION OF THE COAST LINE.

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With Diagrams.

I.—General Remarks.

THE Island of Ceylon has the peculiarity of being surrounded by a submerged plateau, which extends to an average distance of twelve miles from the land. The edge is strongly marked: first by a drop, in most places of 400 feet in about 200 yards, and then of 3,000 feet more in two miles; the oceanic depth of 6,000 feet (or 1,000 fathoms) being reached at about eight miles beyond that again. (See figs. I., II., and III.)

To the northward the plateau merges into that surrounding the south-eastern coast of India, off which a similar formation prevails; but to the southward it gradually deepens, still preserving its shelf-like form along the eastern, western, and southern coasts of the Island, and is both narrowest and deepest (as regards soundings) in the vicinity of Dondra Head.

The 100-fathom line, which may be taken as the outside edge of the plateau, follows the general trend of the coast line; but off the eastern side of the Island there are several remarkable deep and narrow notches, the two most notable of which are off Trincomalee (Koddiyar Bay) and five miles north of Batticaloa respectively, where the point of the deep water approaches to less than a mile off the shore in the first instance and to within two miles in the other.

I am unable to speak definitely of the rest of the plateau, except of that part which occurs within the limits of the "Sealark's" survey during the last two years, as represented in fig. I., and in that area but one notch occurs, namely, off Panadure, where the 100-fathom line approaches the coast to within about nine miles.

In fig. I. it will be seen that the plateau shoals progressively from the south towards the north. The average depth at the southern part is about 36 fathoms, and this continues to abreast of Barberyn lighthouse, at which point a gradual shoaling begins, until, just northward of Colombo, the plateau is covered by only 20 fathoms of water.

A characteristic feature of the plateau is that there is a slight deepening—a sort of irregular channel—running along its central line and parallel to the outer edge throughout nearly the whole of its length.

Where the plateau is of an average depth of 35 fathoms this depression is, roughly speaking, of a depth of 42 fathoms; and where, as off Moratuwa, the general depth is 23 fathoms, the depression is about 33 fathoms. Near Colombo, however, this feature becomes lost; and, instead of a depression, there is, on the other hand, a series of banks: one with a depth of but 10 fathoms, the others less shallow.

The 20-fathom line also, which gradually increases its distance from the coast between Galle and Mount Lavinia, takes a most decided bend outward at this point, and, together with the banks referred to, causes a marked general shoaling on the plateau in this neighbourhood.

Fig. II. represents a section taken from the "Haycock" (Hinidumakanda) to the coast at a spot about ten miles eastward of Galle and through the narrowest part of the plateau.

Fig. III. gives a section from the same mountain through Waal island (at the south-west corner of Ceylon), and again through the plateau into the deep water beyond, the plateau at this point being of average width and normal character. The vertical scale in each case is the same as the horizontal scale, so that the plateau and the fall into deep water are shown with their true relativity, though the central gully is scarcely realized.

A section taken through Colombo would exhibit very similar features to both figs. I. and II. as regards the plateau, but the land being low and level for many miles inland it would scarcely be apparent as an elevation on this scale, which is 6,000 feet to one inch.

The above characteristics may therefore be thus summarized:—

(1) The plateau extends on an average to a distance of twelve miles from the coast with depths slowly shoaling from the southward to the northward from 40 to 20 fathoms.

(2) In all parts a sudden and very well-marked drop into oceanic depths occurs at the outer edge.

(3) A slightly deeper channel or gully is found in the centre, tapering off to the northward, and ended by

(4) A marked shoaling, and the existence of banks, beginning off Mount Lavinia and extending to the northward.

II.—Effect of the Plateau upon Current and Swell.

It must be supposed that such a natural barrier fringing the coast would cause some considerable modification in the direction and speed of the ocean currents reaching the vicinity of Ceylon, as

well as on the swell accompanying the monsoons, on each side of the Island.

Currents.—It would be beyond the scope of these remarks to discuss the ocean currents of the Indian Ocean, the Bay of Bengal, and of the Arabian Sea; but it is necessary to note that Ceylon lies within touch of all three systems; and it is probably due to their mingling near these shores that so many perplexities and discordances have been recorded by navigators approaching the Island.

The main oceanic currents alter their path (but not their direction) throughout the year, moving north and south with the sun. The change of monsoon is also occasioned by the same alterations in position of the source of heat, and it is thus convenient to refer to the currents in connection with the monsoons, for the changes in each take place, necessarily, at about the same times of year. It seems improbable that one is actually occasioned by the other: the currents by the monsoons, or *vice versâ*. The effect in either case would seem too great for the cause under such a hypothesis.

The combined general effect on the coast of Ceylon, however caused, is that the currents circulate round the Island in the direction of the hands of a watch during the north-east monsoon period, and contrary to the hands of a watch during the south-west monsoon. At the change of monsoon the currents are variable; that is, they do not alter suddenly from one direction to the other.

As regards their rates, the greatest recorded occur off the eastern coast during the months of December and January, and then vary from $1\frac{1}{2}$ to 4 knots. (One knot means one nautical mile per hour.) Off the western coast the current never runs more than about one knot, being strongest in January and August.

The above statements of the direction and speed of the currents must be taken as very broad; for, in my own experience, when sounding off the western and southern coasts of the Island, or at anchor (when definite observations for current alone are possible), the surface currents were often found to be of the "wrong" character for the time of year; and not only that, but on steaming outwards on a line of soundings from the coast (which necessitates the accurate positioning of the ship by the land every few minutes), two perfectly distinct sets of the current have not infrequently been observed, running in diametrically opposite directions, within a mile or less of one another and parallel to the shore. This has also been reported on the eastern side of Ceylon.

The plateau probably has a considerable part in producing these results. The actual depth of oceanic and indeed of all currents is still a matter of great controversy; and such observations as exist for the Indian Ocean and these coasts refer solely to *surface* currents. It is very possible, and indeed probable, that the lower layers of water are moving with different speeds and directions to that of the surface, actuated by differences of temperature, salinity,

by the topography of the bottom over which they are travelling; and other reasons. It cannot therefore definitely be said how the outer wall of the plateau acts as a deviator of the ocean currents in this case. If the current is deep, it would of course play a very important part, but if shallow, less so. In any case the increase which would be caused in the ocean temperature by the sudden alteration in depth from 1,000 fathoms to 35 fathoms within a few miles must have a profoundly modifying effect. It may also be conjectured that the gully in the middle of the plateau may produce some alteration in the speed of the currents, if the currents reach so far down.

Swell.—As regards swell, it is possible to speak more definitely. How and where the motion *through* the water known under that name originates it would be difficult to say; but it is certain that its effect is greatly increased, and finally converted into motion *of* the water—*i.e.*, breaking waves—on coming into shallows.

This is clearly seen along the south-west coast of Ceylon, where it is no doubt aggravated by its 12-mile journey over the plateau before it reaches sufficiently shallow water to break, as it does, in enormous rollers on the beach.

The shoaling of the plateau to the northward, and especially the presence of the banks before mentioned (which lie exactly in the line of the south-west swell on its path towards Colombo), make an extremely well-marked difference in the amount of the swell, which is both higher and more constant in this locality than, say, 30 miles farther south, as at Barberyn (Bentota district).

Had this fact been known, it should have been an additional reason against the attempt to build a harbour at Colombo which should be clear of swell—an attempt which, as we see, has hitherto been attended by failure. Almost any other notch in the coast to the southward (and especially Galle, off which bay the plateau is considerably deeper and narrower) would have offered a better chance of success from this cause.

Character of the Bottom.—During the course of sounding operations it is usual to obtain specimens of the material forming the floor of the sea. On Fig. I. the general appearance of these specimens is given beneath the figures representing the depths. Dr. Willey, to whom the samples were sent, reports that the specimens from the shore plateau consist of shelly and coralline *débris*, worm tubes, bryozoa, echinoderm spines, foraminifera, &c., almost entirely calcareous. A sample from 185 fathoms, on the other hand, from outside the plateau, though on its exterior slopes, consists of caked and powdery mud, principally calcareous, with a few minute quartz grains, siliceous spicules, and organic particles. In fact the bottom in the deeper water over the edge of the plateau consists of fine mud, essentially the same at all depths and all stations, containing numerous calcareous remains of foraminifera, chiefly Pulvinulina.

The deep sea mud off the plateau of Ceylon has a greenish coloration, which Mr. M. Kelway Bamber, F.I.C., F.C.S., pronounces to be organic in nature, dissolving out in hot alcohol, and leaving an amorphous green colour on evaporation, easily soluble again in alcohol. Mr. Kelway Bamber has kindly undertaken a chemical analysis of this mud, and the results are given in the Note accompanying this paper.

It is noticeable that the area in which occurs what I have termed "green mud" is the deep water outside the plateau, whilst on the plateau we found only brown sand, broken shells, and occasionally broken coral, always in very small quantities. This would seem to point to the probability of currents existing along the bottom over the surface of the plateau, preventing the accumulation of soft material composed of light particles, such as is represented by the "green mud" of the greater depths. When at anchor in 12 fathoms on the easternmost of the three small banks off Mount Lavinia, a diver from the ship procured a specimen of the bottom for investigation. He reported the surface to be flat, smooth, and hard, without sand or any loose material lying on it. The specimen, which had to be levered up from its position with an iron bar, consists of coral, which Dr. Willey informs me to be Porites coated with nullipore in places.

The green colour above noticed is usually associated in bottom specimens with "terrigenous" material, and is found only on continental slopes. On reaching true oceanic depths the deposits are almost invariably coloured gray, or pale brown (except in the cases of recent volcanic upheavals).

More extended collection of specimens round the outside of the plateau will, no doubt, produce the correct reasons for the occurrence of the green coloured deposit, and also the outside limits at which it is found from the coast, but since the material is not of a properly constituted "oceanic" colour, but rather "terrigenous," we may suppose that its greenness is due to the finer washings of the detritus from the rivers, which, held in suspension for a considerable period in the sea water by reason of their lightness, have been carried by the surface current over the edge of the plateau and not deposited until deep water has been reached; while the coarser and heavier particles have remained behind to be acted on by bottom currents near the land and on the plateau. These conjectures refer solely to the southern and western surroundings of the Island, no specimens having yet been obtained elsewhere.

III.—The Coast Line of Ceylon.

I do not know whether the considerations which I now propose to set forth have been previously advocated, but while dealing with the plateau, the currents, and swell, I should like to point out an effect on the coasts of the Island, which is probably due to these

oceanic causes, in combination with others originating in meteorological conditions affecting the land. I refer to the growth and changes in the coast line.

My attention was drawn to the matter first of all by the strange absence of coral reef the whole way round the southern half of Ceylon, from Chilaw to Trincomalee. It is true that little patches occur here and there, as at Hikkaduwa and Galle, but after a considerable experience of tropical seas, it seemed remarkable to me that there was not only no wide fringing or barrier reef to Ceylon, but that scarcely any specimens were brought up on the lead whilst sounding.

The brown colour of the sand forming the beach round the southern shores would alone point to the absence of coral, being so dissimilar to the typical glaring whiteness of the beach behind a coral reef.

The first explanation that occurred to me was when journeying by the coast railway. I saw in the vicinity of Ambalangoda the strange spectacle of natives digging coral out of an apparently not very ancient reef, which is now about half a mile from the coast, and covered by four or five feet of black humus.

It is thus apparent that the coast line, in that locality at any rate, is in process of extension outwards ; and it seems possible that the following considerations point to such a process being not only continuous, but sufficiently rapid to prevent the growth of coral, except in favoured corners, such as that now to be seen by the resthouse at Hikkaduwa, or as in the case of the reef, now overcome by the accumulation of soil, that I saw from the train, which may originally have been similarly circumstanced.

Attention is now called to the existence and distribution of the lakes that fringe the coast line of Ceylon, as exhibited in fig. IV., and it will be noticed that—

(1) These lakes or lagoons occur practically all round the Island ; but

(2) In much greater frequency on the east coast than on the west, and to the north than to the south ;

(3) That while those to the southward are now all enclosed from the sea and become fresh, those to the northward—Negombo, Puttalam, Jaffna, and Batticaloa, for example—are still open to the sea and salt ; and that

(4) While those still open to the sea on the west of the Island have been formed by bars of sand, &c., pointing to the north, those on the east of the Island have their bars pointing in the other direction, namely, to the southward.

It will further be remarked, under the above numerical headings, that—

(1) The contributing causes must be of a similar nature in all cases ; but

(2) Differing in degree, not only according to the side of the Island, east or west ; but

(3) Also as between north and south ; and that

(4) One of the moving causes emanates from the south, and the other from the north.

I beg to offer the following suggested explanations :—

Firstly, in a large and general way, it is noticeable that Ceylon is constructed in two marked divisions, namely, mountain country and flat country ; there is scarcely any midway between them ; and the hills, whether isolated or taking the mountain district as a whole, appear each to be swimming in a flat ocean of soil (if one may use such a simile) from which they spring abruptly.

The next large point to be noticed is that the greater part of the flat country is spread out to the northward of the hills, tailing off in a point of lagoons and shallows ; but that there is also a spreading out of flat land to the eastward and westward, though not so extensive, and practically none at all to the extreme south.

A consideration that here intervenes is the probability that the mountain region of Ceylon has never been submerged at any time ; or if it has, not for any great length of time, and this is evidenced by the entire absence of chalk or sedimentary limestone, or of any calcareous aqueous deposit. The Ceylon mountains have existed, it may confidently be stated, in their present average condition since their first formation, giving a condition of stability and a field for the continuous action of denudation for immense ages.

What the meteorological conditions of Ceylon were at the time of its first appearance it would be hard to say ; but a good antiquity may be predicted for the monsoons, which have probably existed as long as the ocean, though modified in degree by the changes in the obliquity of the ecliptic.

And, springing from the same cause as the monsoons (namely, the annual movement of the sun and its heat focus), the ocean currents have similarly visited the Island with equal regularity and antiquity.

The point to which I am leading is this, namely, that the low-country of Ceylon has, on the whole, been derived from the denudation of the mountain country, and has been laid down on a plateau, of which we now find remaining a 12-mile fringe surrounding the Island.

Following these prefatory remarks, I now refer to the four points for consideration above stated in numerical order :—

(1) The soil of Ceylon is on the whole friable, and easy to be detached and washed down by the monsoon rains on either side.

This, one may suppose, has always happened, as it is now happening, each river carrying to the coast from the inland vast loads of detritus on every day that it is affected by the monsoon rain—material which, on reaching the coast, has been carried by the sea currents and deposited until it has formed the outline of the shore that we now see, an outline which it is still extending and altering.

The method of extension seems to be, first, the formation of bays along the coast, by the gradual banking up of sand and detritus at some little distance from the shore line, banks originally induced perhaps by some obstacle, such as a slight rocky ridge. The banking process seems to continue until the bay becomes a lake—at first salt, then more and more brackish by degrees, and finally, after many monsoons, perfectly fresh.

The succeeding process would no doubt be that such a lake would slowly fill up with vegetable humus and detritus due to the rains, until it assumed its final stage as a slight depression in the land or as a swamp.

Note should here be made of the fact that the coast extension work probably takes place chiefly during the south-west monsoon period on the western side and during the north-east monsoon on the eastern, for it is during these periods that the heaviest rainfall occurs in each case, bringing the necessary material down to the coast.

(2) There is, however, a marked difference to be noticed in the results, due to the different character of the two monsoons.

The south-west monsoon rains, speaking generally, fall steadily and constantly, and the greater amount of moisture in the air throughout the year on the western side of the Island induces a dense vegetation, which tends to hold together the particles of soil.

The north-east monsoon rains, on the other hand, though less in total amount, fall with great violence and suddenness on a soil which has for several months been exposed to the action of a fierce unclouded sun and an intensely dry air, so that it is in a defenceless condition against the momentum of the sudden torrents of water by which it is assailed.

It is probable, therefore, that a larger amount of detritus is carried down to the eastern coast than to the western, thus occasioning a larger number of lagoons on that side; and also the fact that the low-country, taken as a whole, is more extensive on the eastern side of the mountains than on the other. There are, besides, many more water-courses from the hills to the eastward to bring down material, though many of them cease to flow during the dry season.

(3) The fact that the lagoons of the northern side are still open to the sea is probably due to the much greater distance that the material has now to be carried from the hills, the freshets not being sufficiently strong to carry it, except, as it were, in loads, a bit at a

time, down to the coast line. The flatness of the course of the streams must also greatly reduce their velocity.

(4) Sufficient time and sufficient material, with transport for the same having now been provided for the formation of the low-country by denudation, it remains to be seen why the extension should have taken place chiefly to the northward. The fact is undoubted ; but the explanation of it is not at all obvious. The currents, at a little distance off the shore at all events, run throughout the year to the southward just as much as to the northward, and on the eastern side with a greater velocity to the south than to the north.

The meteorological conditions in ages past and the trend of the ocean currents may have been different, when the Island of Ceylon was represented by the mountain country, from those now existing, and in any case the gradual northward growth of the land would slowly deviate the courses of the streams in the sea.

No observations have yet been made, but it seems at least possible that there is, on the western plateau at all events, a steady current *along the bottom* making to the northward. The diver employed in obtaining the bottom specimen from the 10-fathom bank off Mount Lavinia (see above) could scarcely keep his legs, owing to the strength of the north-going current over the bank, which itself had been swept bare of sand or other loose matter, no doubt from this cause.

It is this which may have formed the protecting arm of Negombo lake, and the still greater one enclosing Puttalam ; and it may quite possibly be the agency that covers with sand and again uncovers the pearl banks. The only evidence of its existence is the barrenness of the plateau to the southward, and its greater depth, as compared with its sandiness northward of Colombo, and shoalness.

The shapes of the mouths of the rivers that occur on fig. I. (which are presented on fig. V. on a larger scale) may be additional evidence as to a north-going current of the present day, so far as the western coast rivers are concerned, since all are formed with sandy peninsulas across their mouths trending to the northward. This is very clear in the case of Colombo, where both the interior peninsula and the present exterior bar of the Kelani-ganga point north, and all the points in the Colombo lake have the same direction.

At Panadure-ganga the flood water breaks out at a weak spot to the southward it is true, yet the *interior* peninsula has grown to the northward ; and there is a small lagoon northward of it again, which may indicate a former mouth. The land in that vicinity is at present occupied by the town of Moratuwa, and human agencies may have been at work to make the river or lake (as it really has now become) empty itself at a different spot.

The Kalu-ganga, having been gradually headed by a bar working up from the south, has now broken out at the northern end; and the Bentota-ganga bar is a complete instance of a northward trend.

The mouth of the Randomba lake (connected with the Madu-ganga), which meets the sea at Balapitiya on the western coast, has a northward pointing peninsula of beach fronting it, and so also has the Madampe lake, not far to the south of it, at Ambalangoda.

The mouths of the Hikkaduwa-ganga and of Ratgama lake (near Dodanduwa) have sand spits directed to the southward; and the Gin-ganga, the next outlet of fresh water along the coast to the southward, has a very decided sandy bar pointing to the south-east.

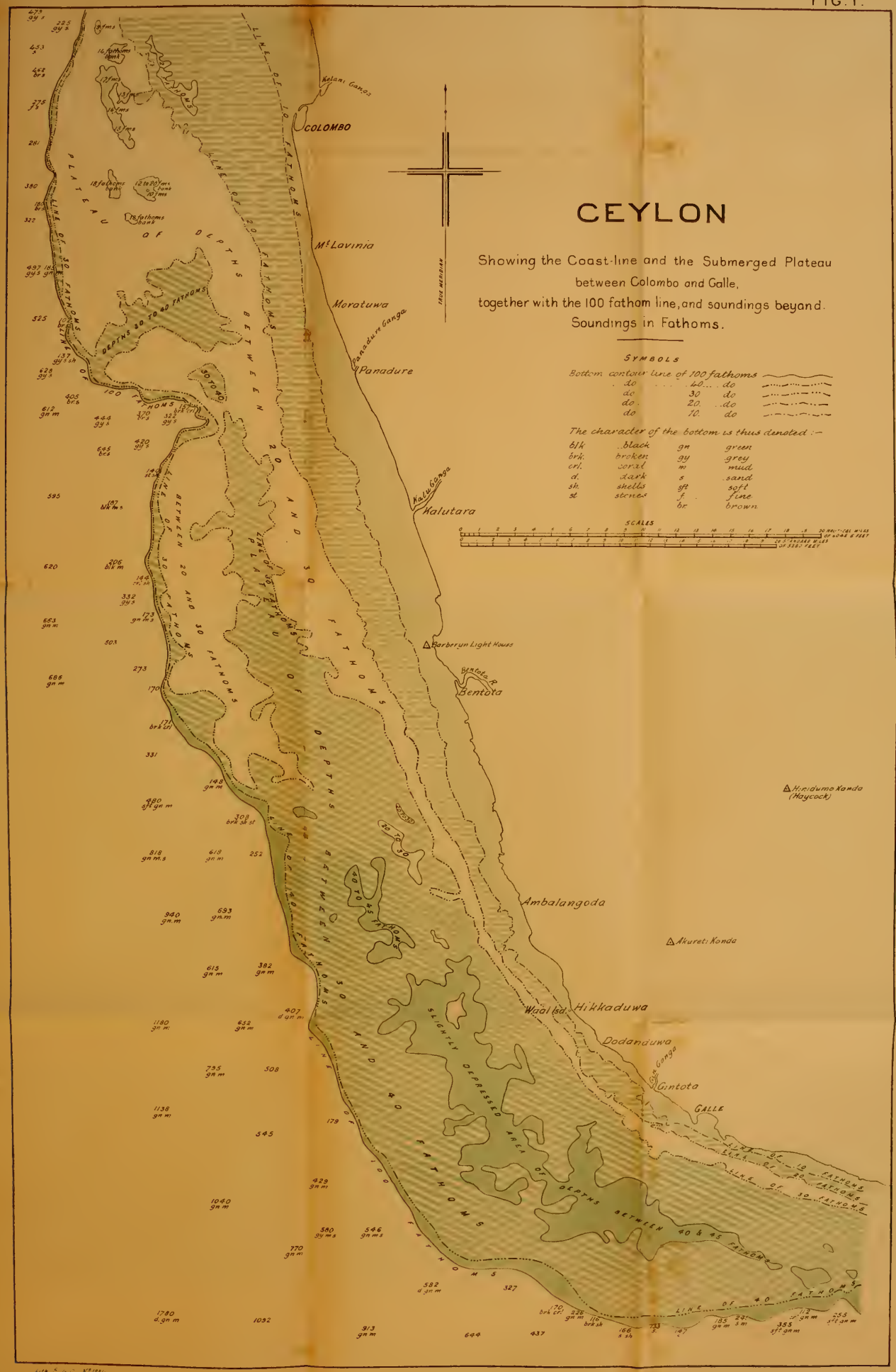
This introduces another proposition as to the formation of the lagoon and river bars, namely, that when the material is brought down the rivers, it is at the time when the monsoon is blowing strongly; and there is not only a "wind-slop" of waves driving before the wind, but also a heavy swell running in the same direction. It is not at all improbable that these forces combined may form a current of no great width—a forced current, as one may say—running along the beach to the northward up the western coast, and to the eastward and southward past Galle, towards the Basses. This theory may possibly suffice to explain the whole phenomenon of the growth of the coast line, but until properly systematized observations of currents with a current meter are taken at various depths over the plateau the problem must remain in doubtfulness.

On the eastern side there is less difficulty of explanation, for the current is running most strongly to the southward at the time of the north-east monsoon and its rains, and thus all the requisite conditions are fulfilled.

It cannot be predicted how long it will be before the coast lines will have worked outwards all round to the 100-fathom line, for there is no reason to suppose that the coast-forming work has now reached a standstill. On reaching the edge of the plateau it will practically cease, from the great depth that would have to be filled up with detritus. This is probably beginning to be felt in the case of the Mahaweli-ganga at Koddiyar Bay, where the edge of the great alluvial plain which has been formed by the river now approaches the head of the deep bight that there occurs in the 100-fathom line, within little more than half a mile.

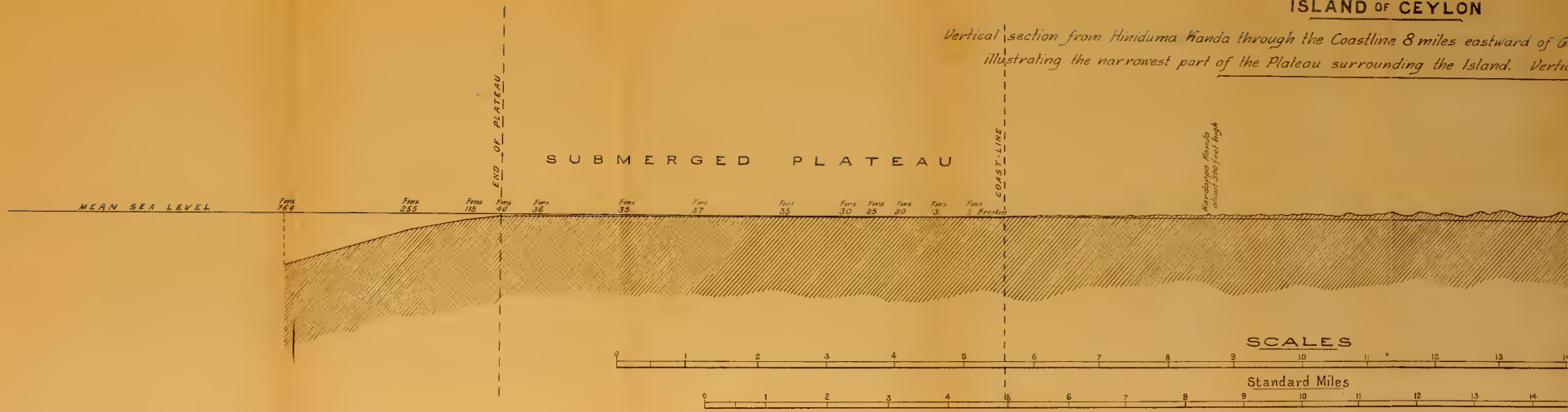
On fig. IV. I have included the more important of the artificial tanks scattered over the low-country. These certainly indicate depressions, which in former days may have held swamps or small lakes, whose presence suggested to the tank builders the improvement of their depths or dimensions. These tanks need not necessarily have once been coastal lagoons, though it is quite within the bounds of probability to suppose so, and especially those that occur near the courses of rivers.

FIG. 1.


CEYLON
Showing the Coast-line and the Submerged Plateau
between Colombo and Galle,
together with the 100 fathom line, and soundings beyand.
Soundings in Fathoms.
SYMBOLS
Bottom contour line of 100 fathoms
do 40 do
do 30 do
do 20 do
do 10 do
The character of the bottom is thus denoted :-
blk black
brk broken
crl coral
d dark
sh shells
st stones
gn green
gy grey
m mud
s sand
gft soft
f fine
br brown
SCALES
COLOMBO
Kelani Ganga
Mt Lavinia
Moratuwa
Panadure Ganga
Panadure
Kalu Ganga
Halutara
Barberyn Light House
Bentota
Ambalangoda
Akuret: Konda
Hikkaduwa
Dodanduwa
Gintota
GALLE
PLATEAU OF DEPTHS BETWEEN 20 AND 30 FATHOMS
SLIGHTLY DEPRESSED AREA OF DEPTHS BETWEEN 40 & 45 FATHOMS
LINE OF 100 FATHOMS
LINE OF 30 FATHOMS
LINE OF 20 FATHOMS
LINE OF 10 FATHOMS

ISLAND OF CEYLON

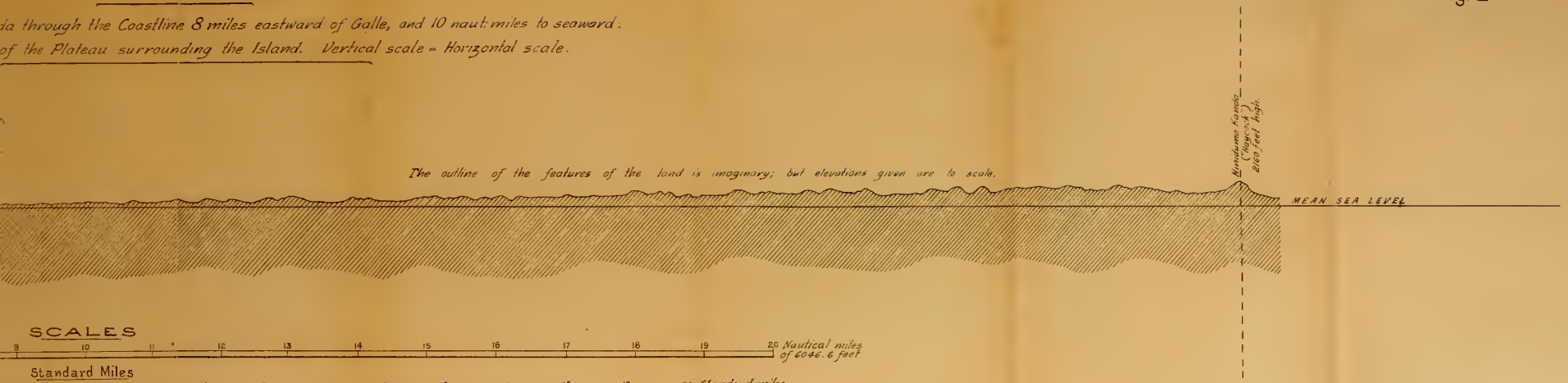
Vertical section from Hiniduma Kanda through the Coastline 8 miles eastward of G
illustrating the narrowest part of the Plateau surrounding the Island. Vertu



ISLAND OF CEYLON

Fig. II

da through the Coastline 8 miles eastward of Galle, and 10 naut: miles to seaward.
of the Plateau surrounding the Island. Vertical scale = Horizontal scale.


The outline of the features of the land is imaginary; but elevations given are to scale.
Kundasale Kanda (Hagala) 2160 feet high.
MEAN SEA LEVEL
SCALES
9 10 11 12 13 14 15 16 17 18 19 20 Nautical miles of 6046.6 feet
Standard Miles
9 10 11 12 13 14 15 16 17 18 19 20 Standard miles of 5280 feet

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ISLAND OF CEYLON.

Vertical section from Hinidumo Kanda through the Coast-line at Hikkaduwa (West Isd.)
illustrating the average width of the submerged Plateau surrounding the Island

Vertical scale = Horizontal scale

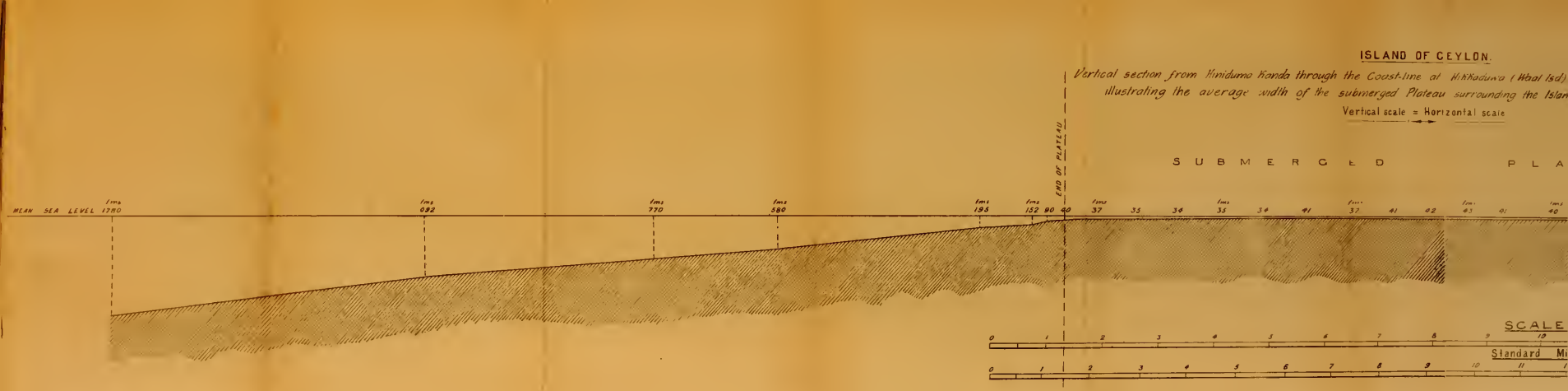


Fig III

ISLAND OF CEYLON.

handa through the Coast-line at Hikkaduwa (Wadi Isd) and 30 nautical miles to seaward
width of the submerged Plateau surrounding the Island, and oceanic depths beyond

Vertical scale = Horizontal scale

E R G E D P L A T E A U.

COAST-LINE (Wadi Isd) Hikkaduwa

RUWEL KANDA about 1200 feet high

The outline of the features of the land is imaginary but elevations given are to scale

MEAN SEA LEVEL

fms	fms	fms	fms	fms	fms	fms	fms	fms	fms	fms
34	41	37	41	42	43	41	40	42	38	33	31	26	20	18

SCALES

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Nout. Miles of 6046.6 feet

Standard Miles

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Standard Miles of 5280 feet

4r 103/0

CEYLON
Scale. 12 Miles to an Inch
Illustrating the salt lagoons and lakes fringing the Island together with the principal Rivers and Tanks
The general outline of the mountain district is also indicated
JAFFNA
Mullaitivu
Elephant Pass
Manaar
Adam's Bridge
Trincomalie
Koddiyar Bay
ANURADHAPURA
Vavuniya
Mullaitivu
Vendelois Bay
BATTICALOA
Chilaw
KURUNEGALA
KANDY
Negombo
MOUNTAIN
DISTRICT
BADULLA
COLOMBO
Kalutara
RATNAPURA
Galle
Matara
Hambantota
Kumana
Little Basses
Dondra Head

FIG V

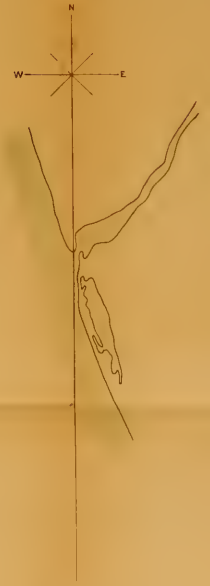
RIVER MOUTHS ON SOUTH-WESTERN COAST OF CEYLON

SCALES.

Kelani Ganga & Colombo Lake

Panadure Ganga

Kalu Ganga



Bentota Ganga

Gin Ganga

A comparison of the species of fishes and other forms of life inhabiting these tanks, with those of the lagoons, both salt, brackish, and fresh, at present situated on or near the coast line, would be of great interest, and would possibly aid in the proof of the conjectures as to their origin, which are here put forward on other grounds.

Note to Commander Somerville's Article.

Analyses of Sea Mud Deposits, by M. Kelway Bamber, F.I.C., F.C.S., &c.

Sample No. 1 is from 615 fathoms, 18 miles west by south from Ambalangoda; No. 2 is from 1,138 fathoms; No. 3 is from 1,180 fathoms, 20 miles west from Dodanduwa. All the samples were of a gray brown colour, which became a greenish gray on drying. When dry all passed through a mesh of 90 to the linear inch, or 8,100 per square inch, the material being in an impalpable condition:—

CHEMICAL COMPOSITION.

	No. 1. Per Cent.	No. 2. Per Cent.	No. 3. Per Cent.
Moisture	4·730	4·480	4·500
Organic matter and combined water	3·850	3·250	3·600
Oxide of Iron	2·400	2·805	3·600
Oxide of Alumina	1·250	1·361	1·482
Manganese	·140	·130	·800
Lime	37·272	32·480	29·200
Magnesia	1·137	·921	1·137
Potash	·366	·550	·424
Phosphoric Acid	·089	·181	·102
Sulphuric Anhydride	19·000	24·850	31·600
Carbonic Acid	27·930	24·720	21·680
Sand and Silicates	·739	3·230	1·634
Undetermined	1·097	1·042	0·241
	100·000	100·000	100·000
	Per Cent.	Per Cent.	Per Cent.
Containing Nitrogen	·308	·336	·476
Equal to Ammonia	·374	·408	·578

Additional Note on bottom samples (*see above, p. 72*).—A sample from 133 fathoms taken on April 6, 1906, 14 miles west off the Clock Tower, Colombo, consists of small calcareous nodules, and shells of foraminifera and pteropoda (pelagic molluscs). Another sample from 155 fathoms, taken on the same date, 13 miles west on the northernmost line, consists of a larger ($1\frac{2}{3}'' \times 1'' \times \frac{2}{5}''$) porous calcareous nodule; this is exhibited in the Mineral Gallery at the Museum, together with dried samples of the green mud from the greater depths.